

The Identity of *Polypodium gyroflexum* (= *Pleopeltis gyroflexa*, Comb. Nov. – Polypodiaceae)

PEDRO B. SCHWARTSBURD

Dept. Biologia Vegetal, Universidade Federal de Viçosa, Av. P.H. Rolfs s.n., Viçosa, MG, Brazil, 36.570-900, email: pedro.schw@ufv.br

ABSTRACT.—*Polypodium gyroflexum* has been a forgotten name since 1940. It is, in fact, an earlier name to a fern recently known as *Pleopeltis repanda*. Here, I provide the new combination, lectotypification, a detailed characterization, and illustrations for *Pleopeltis gyroflexa*, comb. nov., plus the synonymization of *Pleopeltis repanda*. *Pleopeltis gyroflexa* is known from two populations located ca. 2500–3000 km from each other, and they show some slight morphological differences. The gap between them comprises Amazon forest, the Amazon River, croplands, disturbed areas, and semi-desert vegetation (Caatinga). A vegetation map with their distribution data is also provided.

KEY WORDS.—Disjunct distribution, Ceará, north-eastern Brazil, *Pleopeltis repanda*, Venezuelan Guayana

Among the first plants collected in the State of Ceará, northeastern Brazil, were those by J. Huber in 1897. Based on this, Christ (1898) published one of the first accounts of ferns and lycophytes from Ceará, citing 28 taxa, two of which he recognized as new: *Pteris pedata* var. *huberi* Christ and *Polypodium gyroflexum* Christ. A more comprehensive account for Ceará was published by Brade (1940), based on Huber's collections and also on a more complete collection made by J. Eugenio in 1937. Brade (1940) recognized 67 taxa (including five new taxa), and regarded *Pol. gyroflexum* as endemic to Ceará. After Brade's publication, *Pol. gyroflexum* has been forgotten, not listed in further accounts of Brazilian ferns (e.g., Barros, Lira, and Silva, 1988; Barros *et al.*, 2004; Labiak and Hirai, 2010), nor in any synonymy.

Smith (1990, 1995), when working on the ferns from Venezuela Guayana, noticed an undescribed *Pleopeltis*, that was unique in having repand lamina margins and lacking scaly paraphyses, and he described it as *Pl. repanda* A.R. Sm. Later, Labiak and Prado (2007) expanded the known distribution of *Pl. repanda* into northwestern Brazil and Guyana.

After analyzing types and recent collections, and performing field expeditions in northeastern Brazil, I have concluded that *Polypodium gyroflexum* and *Pleopeltis repanda* are conspecific. *Polypodium gyroflexum* has priority over *Pl. repanda* by almost 100 years; thus, the new combination for *Pleopeltis gyroflexa* in *Pleopeltis* is here provided, along with the synonymization of *Pl. repanda*.

MATERIALS AND METHODS

Images of the type collections were analyzed through the websites of JStor Plant Science, and University of California and Jepson Herbaria. Materials

from ALCB, HRB, and HUEFS herbaria were personally analyzed. Other herbaria from northeastern Brazil were visited, but they did not have specimens of *Pleopeltis gyroflexa*.

The map was drawn using the software DIVA-GIS (Hijmans, 2013). For collections with no coordinate data, I estimated locations through searches in GoogleTM Earth. Since the record for Guyana is based on an informal communication (see Labiak and Prado, 2007: 119), I added it near the border between Venezuela and Brazil.

Several localities in northeastern Brazil were visited during March–May 2011, especially in the States of Bahia, Pernambuco, and Ceará. Only one population of *Pleopeltis gyroflexa* was found, in Serra do Baturité, Ceará.

RESULTS

Pleopeltis gyroflexa (Christ) Schwartsb., **comb. nov.** for *Polypodium gyroflexum* Christ, Bull. Herb. Boissier 4:994. 1898. TYPE: BRAZIL. Ceará: Serra de Baturité, Guaramiranga, epiphyte sur les caféiers, [auf cafestrauchern hinfig], Sep 1897, *J. Huber s.n.* [g120] (lectotype, here designated: P-00633206, image seen; isoelectotype: MG-n.v.). Figs. 1A–E.

Pleopeltis repanda A.R. Sm., Ann. Missouri Bot. Gard. 77:259, Figs. 3A–D. 1990. TYPE: VENEZUELA. Bolívar: Altiplanicie Nuria, upper part of west-facing wooded slopes, E. of Miamo, 300–500 m, 8 Jan 1961, *J.A. Steyermark 88177* (holotype: UC, image seen; isotype: US, image seen).

Plants epiphytic. *Stems* creeping, 3–4 mm diam., scaly; *scales* peltate, lanceolate, $1.5\text{--}2.5 \times 0.4\text{--}0.8$ mm, centrally black, margins clathrate and erose-denticulate, commonly comose. *Fronde* subdimorphic, the *fertile* 25–40 cm long, with margins strongly repand, the *sterile* 20–25 cm long, with margins sinuous; *petioles* abaxially terete, adaxially grooved, $3\text{--}5 \text{ cm} \times 1\text{--}1.5$ mm, light brown, glabrous; *fertile laminae* coriaceous, $20\text{--}35 \times 1.3\text{--}2.8$ cm, linear-elliptic, broadest in the proximal 1/4 or in middle, the *bases* attenuate to cuneate, the *apexes* attenuate, the *margins* entire in the lower half, strongly repand in the distal half, abaxially with sparse lanceolate peltate *scales*, 0.3–1 mm long, brown to blackish, with light brown margins, adaxially glabrous; *sterile laminae* coriaceous, $15\text{--}20 \times 1.2\text{--}1.8$ cm, linear-elliptic, broadest in the middle, the *bases* attenuate, the *apexes* cuneate to acute, the *margins* irregularly sinuate, the *indument* similar to fertile laminae; *rachises* abaxially and adaxially terete, stramineous with dark dots, essentially glabrous but with a few scales abaxially; *veins* irregularly anastomosing, adaxially some ending in dark hydatodes; *sori* submarginal, oblong to reniform, $3\text{--}5 \times 2\text{--}3$ mm, in one row on each side of midrib, not sunken, without scaly paraphyses; *sporangia* with long pedicels, 0.5–0.7 mm long, persistent on receptacle after capsule fallen; *spores* reniform, monolete, whitish or yellowish.

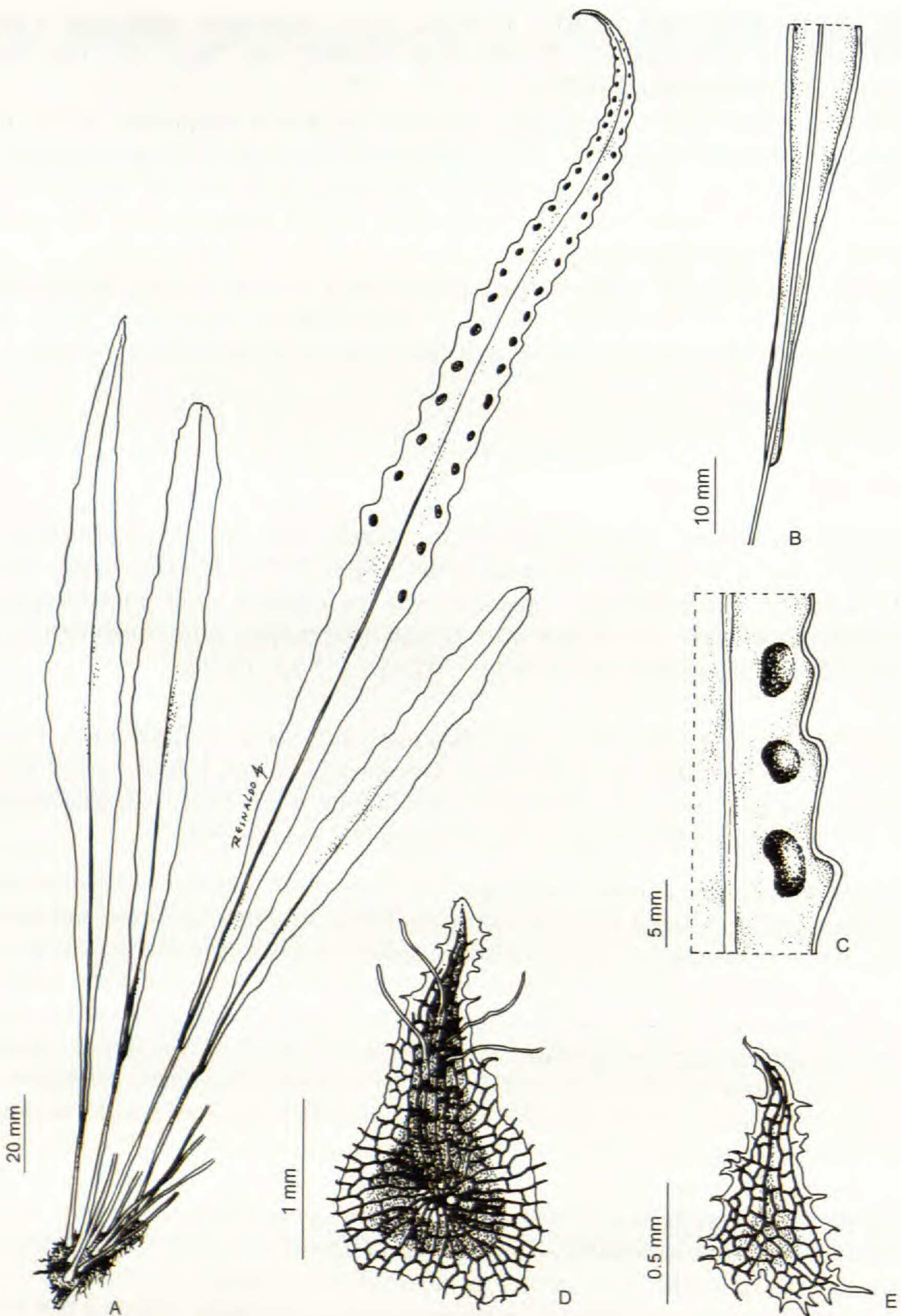


FIG. 1. *Pleopeltis gyroflexa* (Schwartzburd 2492): A. habit; B. proximal part of abaxial lamina; C. detail of sori and abaxial laminar margins; D. stem scale; E. laminar scale. Drawn by R. Pinto.



FIG. 2. Distribution of *Pleopeltis gyroflexa* and its two disjunct populations, plotted on a vegetation map. White circles: western population; white triangles: eastern population. Drawn using the software DIVA-GIS.

Distribution and ecology.—Two segregated populations. Western population: eastern Venezuela (in the State of Bolívar), Guyana, and northwestern Brazil (in the State of Roraima), where it occurs as epiphyte in the herbaceous-bushy vegetation at the edges of the Amazon Forest; 300–1050 m elev. Eastern population: northeastern Brazil, in the States of Ceará and Bahia (possibly also in other north-eastern States), where it occurs as epiphyte in wet *inselberg* forests and riparian forests; 400–850 m (Fig. 2).

Additional specimens examined.—BRAZIL. Ceará: Baturité, Serra do Baturité, 700–800 m, 9 Apr 2011, *P.B. Schwartzburd & M.F. Moro* 2492 (SP, UPCB, VIC); Pacatuba, Serra de Pacatuba, ca. 03°58'S, 38°47'W, ca. 450 m, 22 July 1997, *M. Almeida Neto & C.A. Meirelles* 206 (HUEFS, SJRP-*n.v.*). Bahia: Cachoeira, Bananeiras, s.d., *C. Torrend* s.n. (ALCB-00311); Cachoeira, Morro Belo, Pedra do Cavalo, ca. 12°32'S, 39°05'W, 40–120 m, Dec 1980, *Scardino et al.* 979 (ALCB, HRB); Jeremoabo, 10°00'14"S, 38°26'02"W, 427 m, 12 Aug 2005, *E.B. Miranda et al.* 901 (HUEFS); Santa Terezinha, 12°51'13"S, 39°28'32"W, 822 m, 25 Oct 2010, *M.L. Guedes et al.* 17847 (ALCB).

Pleopeltis gyroflexa is easily recognized by its relatively large fertile fronds (25–40 cm long), repand laminar margins, and lack of scaly paraphyses (even in young fronds). Although the presence of scaly paraphyses has historically

been a key feature for the circumscription of *Pleopeltis*, soral scales are not present in all species, as recently pointed out (Otto *et al.*, 2009; Smith and Tejero-Díez, *in press*). In many other aspects (e.g., stem scales blackish, clathrate, peltate, and comose, laminae abaxially with peltate scales, veins irregularly anastomosing, sori roundish and submarginal to marginal), *Pl. gyroflexa* perfectly fits within the concept of *Pleopeltis* (*sensu* Mickel and Smith, 2004; Otto *et al.*, 2009; Smith, 1995; Smith and Tejero-Díez, *in press*). Due to the coriaceous undivided laminae and blackish comose stem scales, *Pl. gyroflexa* presumably fits within the “*Pleopeltis macrocarpa* group” (*sensu* Hooper, 1995). But, Smith and Tejero-Díez (*in press*) suggested *Pl. repanda* may not be an element of this clade.

Pleopeltis gyroflexa is somewhat similar to some specimens of *Pl. macrocarpa* (Bory ex Willd.) Kaulf. with sinuous laminar margins. *Pleopeltis macrocarpa* is widespread in the Neotropics (also in some parts of the Paleotropics — e.g., Smith, 1995; Smith and Tejero-Díez, *in press*), and might possibly occur sympatrically with *Pl. gyroflexa*, or at least nearby (see distribution presented by Barros *et al.*, 2004; Smith, 1995). *Pleopeltis gyroflexa* differs from *Pl. macrocarpa* by sparse, lanceolate laminar scales with light brown margins (*vs.* scales numerous, rounded to lanceolate, with whitish margins), sori oblong to reniform and not sunken (*vs.* sori round and sunken; the soral impressions adaxially visible), and lack of scaly paraphyses (scaly paraphyses present and numerous) — Figs. 1A–E.

Pleopeltis gyroflexa is known from two markedly disjunct populations, which are distant ca. 2500–3000 km from each other. Within this gap are the Amazon Forest, the Amazon River, croplands, disturbed areas, and the Brazilian semi-desert vegetation (*Caatinga*; Fig. 2). The western population occurs in eastern Venezuela (Bolívar), Guyana, and northwestern Brazil (Roraima); and the eastern population occurs in northeastern Brazil (Ceará and Bahia). In both areas, collections are few, indicating this species might be locally rare and not very successful in spreading — see examined material above, and material cited by Smith (1990, 1995) and Labiak and Prado (2007).

Some slight morphological differences exist between these two populations: in the western, the laminae are 1.7–2.8 cm wide, proximally cuneate, and broadest in the proximal 1/4 (see Smith, 1990: Fig. 3A); in the eastern, the laminae are 1.3–2 cm wide, proximally attenuate, and broadest in the middle (Figs. 1A, B). In addition, the sori in the western population are present in the distal 2/3 of laminae (Smith, 1990: Fig. 3A), while in the eastern, they are confined to the distal 1/3 of laminae, or rarely in the distal 1/2 (Fig. 1A).

These two populations may represent two different taxa at an infra-specific rank, but further collections and studies are needed. For now, several hypotheses can be made to explain this uncommon distribution, and these may be tested in the future by genotyping populations and performing biogeographical analyses: 1. *Pleopeltis gyroflexa* was once widespread in northern South America (in areas not occupied by Amazon forest), and the two populations now represent relictual populations generated by vicariance; 2. *Pleopeltis gyroflexa* is an element of the *Pl. macrocarpa* group (originated in

Mexico/Mesoamerica, with further radiation into South America – Otto *et al.*, 2009; Smith and Tejero-Díez, *in press*), with an established population in the Guyana region and a further long-distance dispersal to northeastern Brazil; 3. *Pleopeltis gyroflexa* is derived from a Brazilian Atlantic Forest element, with a further long-distance dispersal into the Guyana region. The main question that remains unanswered is: does gene flow remain between the two populations, or are they totally isolated from each other?

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